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REPORT

A STUDY OF GEMINI

AND APOLLO PHOTOGRAPHY USERS

DENVER RESEARCH INSTITUTE
UNIVERSITY OF DENVER

A STUDY OF GEMINI AND APOLLO PHOTOGRAPHY USERS

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- Prepared for -

National Aeronautics and Space Administration

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October 1969

DENVER RESEARCH INSTITUTE—UNIVERSITY OF DENVER

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SUMMARY

Findings and Conclusions

(1) Almost half of the customers of the Technology Applications Center (TAC) are academicians, primarily at the university level. Industrial users involved in the oil, natural gas, and mineral exploration industries represent the second largest segment of users.

(2) Individuals with disciplinary backgrounds in the earth sciences, primarily geology, comprise nearly 70 percent of past Gemini/Apollo photographic users. Among users there was a general absence of individuals with disciplinary backgrounds in other technical areas, such as engineering and the physical sciences.

(3) The quality of the photographic materials distributed by TAC appears to be more than adequate for the needs of present users.

(4) A sizable portion of past customers think that quantity and quality of supporting information accompanying the photographs needs improvement. Some respondents thought that there were not enough interpretive aids included.

(5) TAC's current promotional program lacks balance. The most significant avenue of communication was through advertisements in Geotimes magazine. Only personel contact ranked high as an additional source of inquiry. Other potentially effective media, such as advertisements in other magazines and journals, direct mail, and presentations at professional seminars appear to offer potential.

(6) The frequency and volume of additional orders from past TAC customers will be limited by the availability of new photographic coverage. No substantial volume should be expected from past users unless expanded coverage becomes available.

(7) Over 70 percent of the survey respondents thought that the photographs were worth more than they cost in terms of the economic and noneconomic benefits derived from their use.

Suggestions

It is suggested that TAC take the following steps to improve its photographic services to present and potential customers:

(1) Expand the photographic coverage now available. To continue to serve the needs of present customers, new photographic materials will be required. To accomplish this Gemini/Apollo coverage may have to be supplemented by additional photographs from NASA and other government services.

(2) Deal with the market by class of user rather than as a single entity.

(3) Increase the effectiveness of the promotional program by using channels of communication which will reach potential markets not currently using TAC photographs. For example, engineers have not been a significant user group. Advertisements in professional journals such as Civil Engineering and presentations at professional seminars may lead to increasing utilization by new user groups. Articles by TAC staff strategically placed in appropriate publications may also increase awareness of application of the photographs and of their availability.

(4) Increase and improve the data which accompanies the photographs.

INTRODUCTION

Background

The Technology Applications Center (TAC) at the University of New Mexico is a NASA-sponsored Regional Dissemination Center (RDC). In addition to the normal functions performed by an RDC,* including selective dissemination and retrospective search services, TAC has the responsibility for disseminating earth-oriented Gemini/Apollo photography. These flights offer photographic coverage of the earth from about 30° North Latitude to 30° South Latitude.

At the present time, TAC has approximately 2,600 usable photographs available for distribution. These photographs may be ordered individually, in sets, or as a disciplinary package. Disciplinary packages contain a set of photographs which are representative of specific examples of topographic, geologic, and other types of earth surface features. At the time of the study the price of photographs ranged from $.50 to $7.50.** Orders typically average $45 to $50, although they have been as large as $3,000. New photographic coverage has been announced through advertisements in Geotimes and R & D magazines, and by inclusion in a TAC photographic catalog. The total magazine advertising expenditures to date have been less then $2,000.

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* Six Regional Dissemination Centers established by NASA help potential users of new technology obtain it in packages appropriate to their needs. No two of these centers are alike. Each one, however, is based at a university or not-for-profit research institute, and staffed with professional personnel skilled in the use of computer search-and-retrieval techniques to assemble information. These centers establish Government-university-industry partnerships by serving fee-paying industrial clients, both large and small, in a variety of ways.

** Prices for the more popular reproduction forms were:

8" × 8" black and white print	$5.00
8" × 8" color print	7.50
2-1/4" × 2-1/4" color slides	.75
35 mm color slides	.50
Catalog of 900 edited slides	1.00

Effective October 1, 1969, the price of photographic material was increased by 60 to 80 percent.

The TAC photographic service operates on a limited scale. Total sales, since the inception of the program, have been less then $50,000. Two professional staff members devote part of their time to the program and receive additional help from a graduate student.

The photo service activity was initiated in early 1966 when TAC representatives contacted the Manned Spacecraft Center in Houston to request copies of photographs from the Gemini flights. Since that ime, TAC has continued to receive copies of all subsequent earth-oriented photographs originating from Gemini and Apollo flights.

Study Objectives

The basic purpose of this study was to increase NASA's and TAC's knowledge of the characteristics of users and uses made of Gemini/Apollo photographs. The research was designed to accomplish five specific tasks:

(1) Identification of market segments.

(2) Determination of how customers have used the photographs received.

(3) Evaluation of the economic benefits derived through the use of TAC-supplied Gemini/Apollo photographs.

(4) Measurement of user satisfaction with the quality of photographs and related TAC services.

(5) Suggestion of approaches for the marketing of photographic materials.

Research Design

The kind of information needed for a market study of this type made the use of a mail questionnaire an appropriate research technique. A cover letter and questionnaire were designed and pretested during personal interviews with Denver area users of TAC-supplied photographs. Respondents were asked to complete the preliminary questionnaire and then to evaluate it once completed. As a result of this pretest, the original questionnaire was modified slightly. (Samples of the cover letter and modified questionnaire are presented in Appendix A.)

Questionnaires were mailed to all past TAC customers. A follow-up letter was mailed to all nonrespondents (208) one month after the initial mailing. The response rate was 74 percent (see Appendix B for response rate by major user category).

Acknowledgements

Appreciation is extended to all the individuals who contributed to the research and to the preparation of this report, especially to the many individuals who contributed their time and efforts to complete the questionnaire.

Special recognition is given to William Shinnick and Thomas Lyons, Technology Applications Center, University of New Mexico, whose efforts were particularly helpful in the performance of this research.

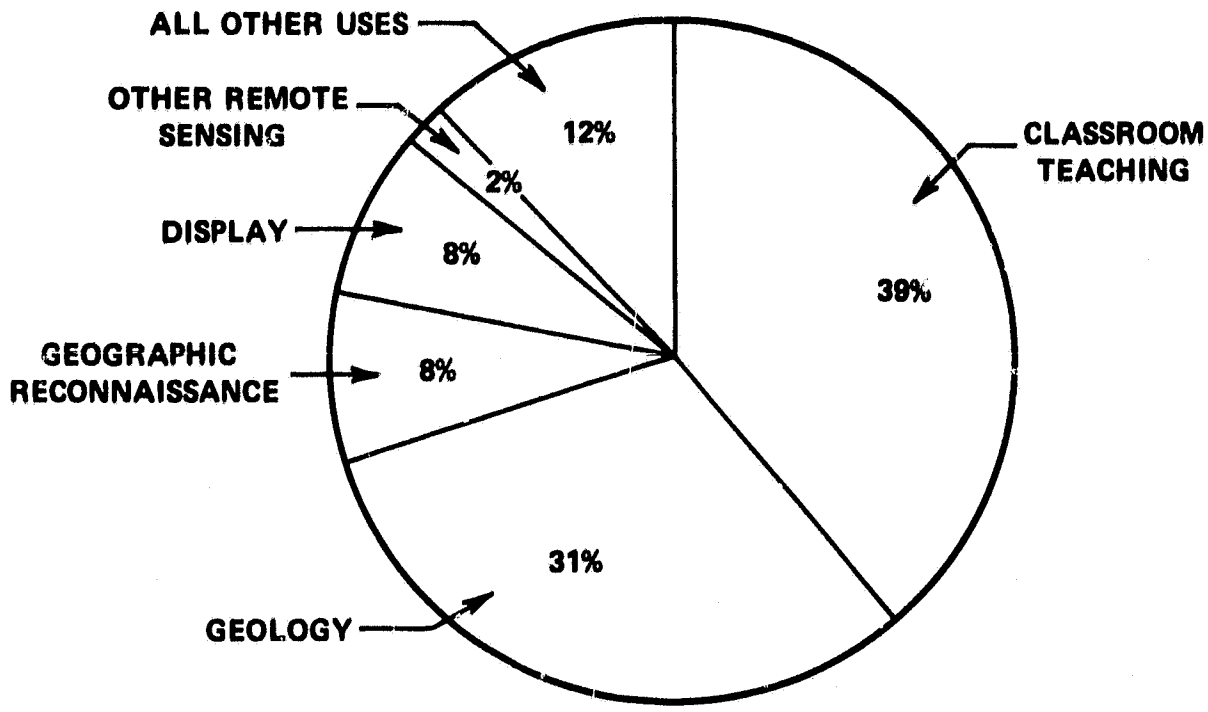
Within the Industrial Economics Division of the Denver Research Institute, the support and contributions of Dean C. Coddington, Ronald J. Hensen, and Theodore D. Browne are greatly appreciated.

SECTION I. USES AND ECONOMIC BENEFITS OF GEMINI/APOLLO PHOTOGRAPHS

Utilization of Photographs

Analysis of customer utilization of Gemini/Apollo photographs revealed differences between the more exotic applications currently featured in journal and magazine articles,* and the majority of current applications. Although a wide variety of uses were mentioned by respondents, two general categories of use, classroom teaching and geological exploration, were predominant (see Figure I-1).

FIGURE I-1. USES OF GEMINI/APOLLO PHOTOGRAPHS



In addition to the primary uses shown in the figure above, nearly half of the respondents indicated that more than one application

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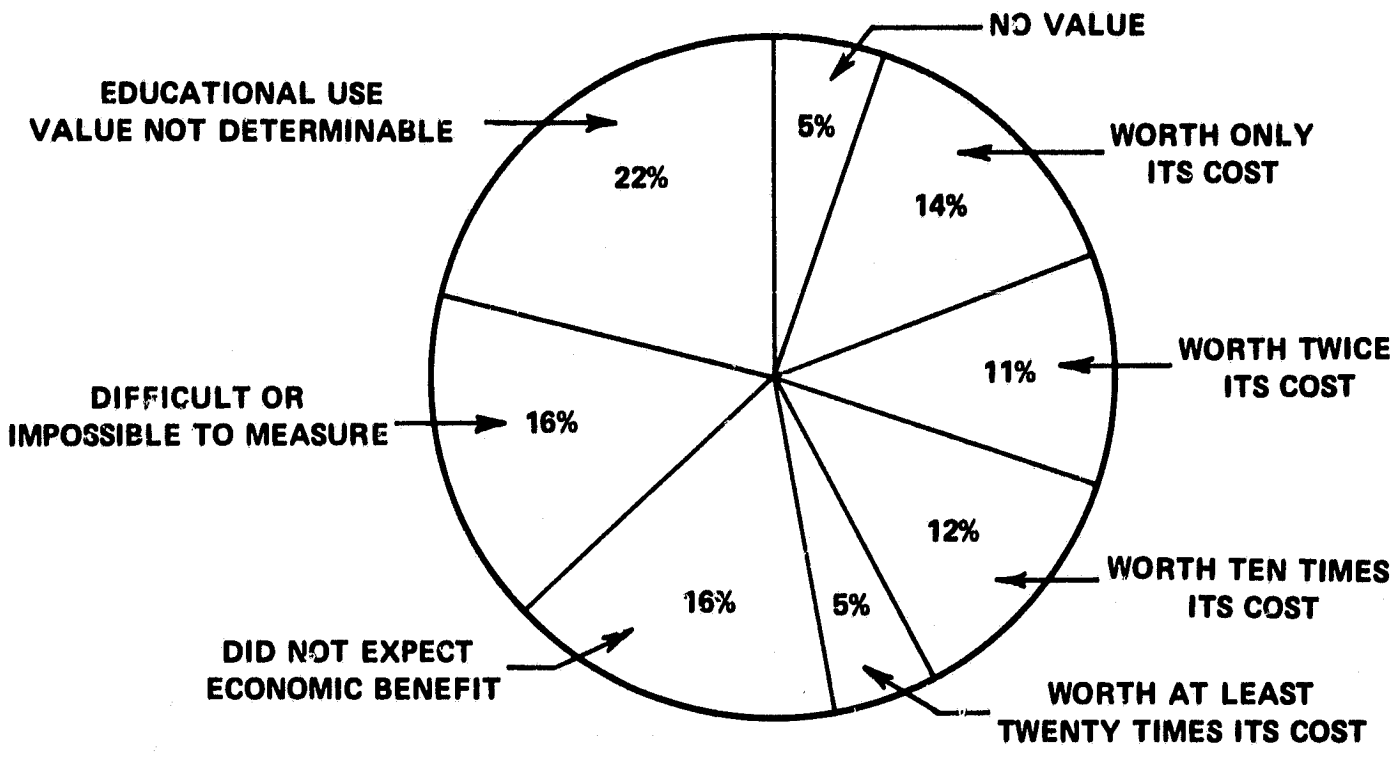
* For example, see Kenneth F. Weaver, "Remote Sensing, New Eyes to See the World," National Geographic, January 1969.

had been found for the photographs (see Appendix C, Table C-8).* Many respondents explained their specific uses in greater detail. Because of the diversity of these responses they were extremely difficult to categorize. Representative statements are presented in Appendix E.

Economic Benefits Derived

Questionnaire respondents were asked to approximate the economic benefits they received from using the TAC supplied Gemini/ Apollo photographs. The responses received are illustrated in Figure I-2 below.

FIGURE I-2. ECONOMIC BENEFITS RECEIVED



* The size of this multiple use phenomenon may have led to an underestimation of economic benefits received from using the photographic materials because the questionnaire asked respondents to estimate the economic benefits "they" had received in "their" work from using the photographs. To the extent that the respondents did not include additional applications within the organization, the economic benefits derived from using the photographs are understated.

Over half of the respondents checked or indicated a response in categories "did not expect economic benefit," "difficult or impossible to measure," or "educational use--value not determinable." Academic users, particularly those using the photographs for classroom teaching, comprise a large proportion of these three categories. Other respondents indicated that either their stage of use of the photographs or their cost accounting procedures did not allow them to make an accurate estimation of the economic benefits they received. Some of the respondents in these three categories did however, indicate that the photographs were worth more than their cost:

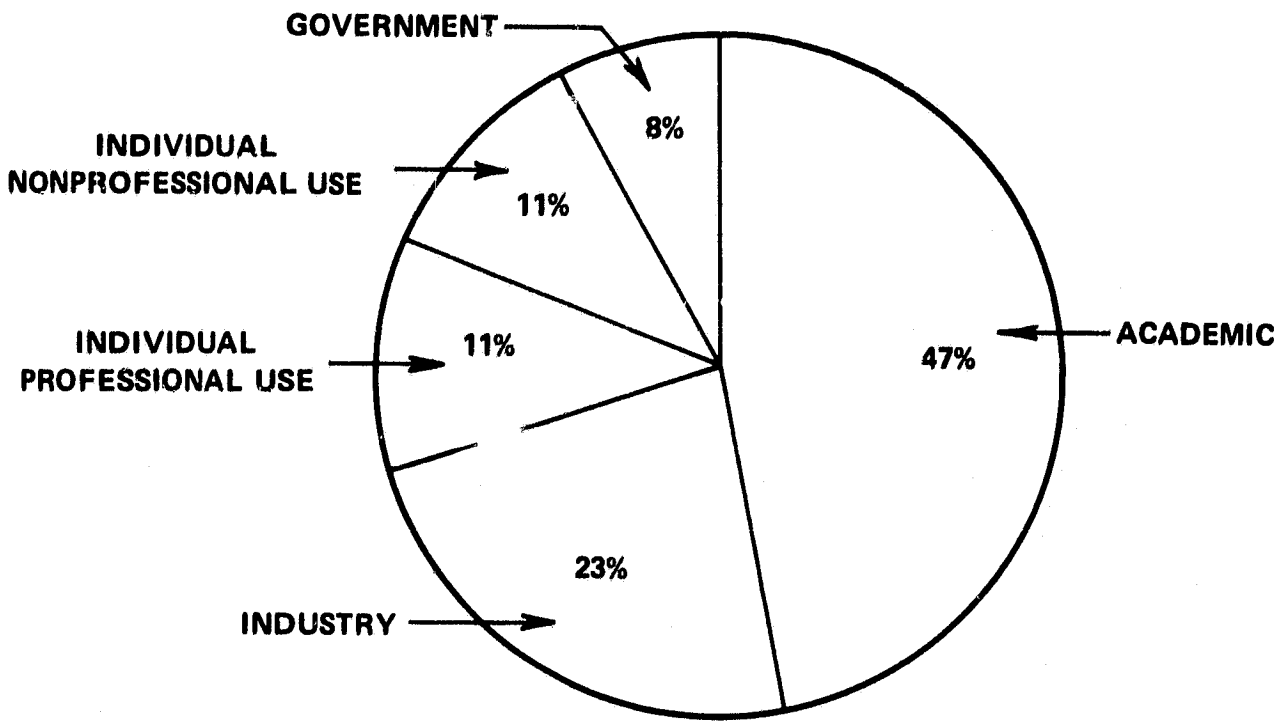
> "No evaluation yet made by us, but I would think it greatly exceeds cost."
>
> "Though of great value to me in geographic lectures, I have not yet derived an economic benefit from them as a geologist. I feel they do have potential in this area, however."
>
> "More than its cost but exact figures are impossible to determine. There are too many intangibles."
>
> "Very difficult to assess, but quite satisfied with price."

It is estimated therefore, that in approximately 95 percent of the cases the photographs led to economic or noneconomic benefits equal to or greater than the cost of the photographs.

SECTION II. USER SEGMENTS

The most meaningful basis for segmentation of the TAC photo-user market is the general organizational breakdown shown in Figure II-1. These general classes of users coincide with variations in applications, communication preferences, and economic expectations.

FIGURE II-1. GENERAL ORGANIZATION SEGMENTS OF PHOTOGRAPHY USERS



Academic Users

Nearly one half of the past users were from the academic community, with over 90 percent of these connected with a college or university. This group is composed almost entirely of geology professors who use the photographs primarily as an instructional aid in classroom teaching (see Appendix D, Tables D-1 and D-2).

At least one group of potential academic users, engineers and scientists interested in remote sensing techniques, have not been

reached in large numbers. Only six percent of the academic users were engineers and most of these were associated with the geological departments of their institutions. Since engineers and scientists of other backgrounds, particularly civil engineers, are showing increasing interest in remote sensing and the related use of high-altitude photographs, it is suggested that TAC explore various means of reaching potential customers in these fields. *

The high proportion of classroom use of photographic materials suggests the development of additional photographic teaching packages. ** One of the academic respondents stated that, "I would like to see more sets developed - complete instructional units . . . ." The possiblility exists that by increasing students' exposure to these photographs, expanded future awareness and utilization of these photographs might be expected in the long run.

Industrial Users

The next most concentrated segment of users, in terms of use and educational backgrounds, is the industrial group. Nearly one out of four of the respondents were from industry, utilizing the Gemini/Apollo photographs in areas connected with mineral, oil, or gas exploration (see Appendix C, Table C-1 and Appendix D, Table D-2). In addition to this, 93 percent of the users in this category had disciplinary backgrounds in the earth sciences (see Appendix D, Table D-1). This concentration of use and disciplinary backgrounds suggests that a continued emphasis on targeting some photographic packages at the oil, natural gas, and mineral exploration industries is warranted.

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* A number of knowledgeable individuals have suggested civil engineering as a potentially significant market for earth-oriented imagery. See particularly the Proceedings of the Fifth Symposium on Remote Sensing of Environment, 16-18 April 1968, Willow Run Laboratories, Institute of Science and Technology, University of Michigan, Ann Arbor, Michigan.

** Written comments by academic respondents suggested increasing the quantity of teaching aids, student problem sets, and general interpretive material.

Individual Users (Professional Use)

This category is mainly composed of private consultants or individuals associated with small consulting firms. The disciplinary backgrounds of this class of respondents are also highly concentrated in the earth science areas (see Appendix D, Table D-1). The main use to which the photographs were put represents more variety than found in either the academic or industrial segments of the market (see Appendix D, Table D-2). Although the predominant use was still in geological analysis and exploration, the photographs were applied to hydrology problems, geographic reconnaissance studies, and a variety of other situations. The diversity of application makes it more difficult for TAC to target a specific disciplinary package and marketing approach to this class of user.

Individuals (Nonprofessional Use)

At least one out of 10 customers ordered and used the Gemini/Apollo photographs for display or nonprofessional uses. Customers of this type typically order a small number of units and consequently, represent less than 10 percent of the total unit volume of photographs distributed. It is not recommended that TAC make any special efforts to follow-up on users of this type.

Government Users

The smallest category of respondents, government users, indicated both the widest range of use and disciplinary backgrounds (see Appendix D, Tables D-1 and D-2). The small proportion of this class of users, however, (less than 10 percent) makes it difficult to develop any meaningful generalizations related to this market segment.

Users by Geographic Location

The largest geographic concentration of TAC customers (over 40%) is in seven state Southwest Region (see Appendix C, C-6). The number of extractive industry main offices and the excellent photographic coverage of this area are two primary reasons for this concentration.

TAC's Albuquerque, New Mexico location places it in an excellent geographical position to serve this large market.

SECTION III. MARKETING ANALYSIS AND EVALUATION

Customer Evaluation of TAC's Product Package and Related Services

Past users of TAC supplied Gemini/Apollo photographs were asked to evaluate six characteristics of the TAC "product package" and related services. A summary of the overall response is presented below in Table III-1.

TABLE III-1. CUSTOMER EVALUATION OF TAC PHOTOGRAPHS AND SERVICES

Characteristics	Needs Improvement	Adequate For Use	Excellent
Photo Reproduction Quality	16%	47%	37%
Photo Color Adequacy	14	53	34
Accuracy of Accompanying Information	41	46	13
Promptness of TAC Service	23	44	33
Applicability to Your Needs	12	58	30
TAC's Advertising of Available Information	58	33	9

Among past users there appears to be no great need for concern over the excellence of the photographic material itself. The current levels of color adequacy and photo reproduction quality were rated favorably by all user segments (see Appendix D, Tables D-8 and D-9).

A somewhat unfavorable response was received concerning the accuracy of accompanying information particularly from academic users (see Appendix D, Table D-11). A limited number of users said that the information they had received was not accurate, although this group was in the minority.

Two comments illustrate the complaints of this group:

> "The catalog is in error describing areas covered by various slides. The maps and catalog do not always agree on the area covered by a specific slide."
>
> "Some disturbing mismatches exist between duplicate shots on different orders, and apparently adjacent frames. 'Accompanying information' is a highly deficient term, based on stuff I have had. Bare identification, maybe."

A few of the respondents indicating a need for improvement did not mention accuracy at all, but thought that there was not enough information accompanying the photographs:

> "I think some type of geographic interpretation of the photographs should be made. For example, is the quality of the space photo good for showing mountains, deserts, water bodies, etc. From the catalogue it is difficult to get this information."
>
> "We need to know more about each of the prints because going through the present catalogues doesn't give enough information. Some type of geographic coding system needs to be used."

The latter group desired more help in evaluating and using what they had received. Consequently, a step in the direction of increasing the usage of these photographs might be to improve and expand related data. As noted earlier in the report, a teaching package might be developed to aid academic users. Customers from the oil and natural gas industry, on the other hand, might prefer additional assistance in the determination of geological features.

With the exception of government and nonprofessional users, the promptness of TAC's service was evaluated favorably (see Appendix D, Table D-10).

Past users were also asked to evaluate the applicability of the Gemini/Apollo photographs and TAC's accompanying service to their particular needs. Respondents thought that the photographs were adequate for use with a sizable number indicating that the photographs

and accompanying information were excellent in terms of filling their needs (see Appendix D, Table D-12). These results imply that the photographs were ordered to satisfy a well defined need in the first place.

The service characteristic receiving the most critical response was related to TAC's advertising of available information (see Appendix D, Table D-13). Written responses implied that most past users thought that they were not being adequately informed about available photographs. Suggestions and recommendations for future improvements in this area are covered later in this section.

With the exception of mild dissatisfaction in two areas, past Gemini/Apollo photographic customers were favorably impressed with TAC's "product package" and related services. TAC appears to have a capability for the handling and distribution of photographic materials of this nature.

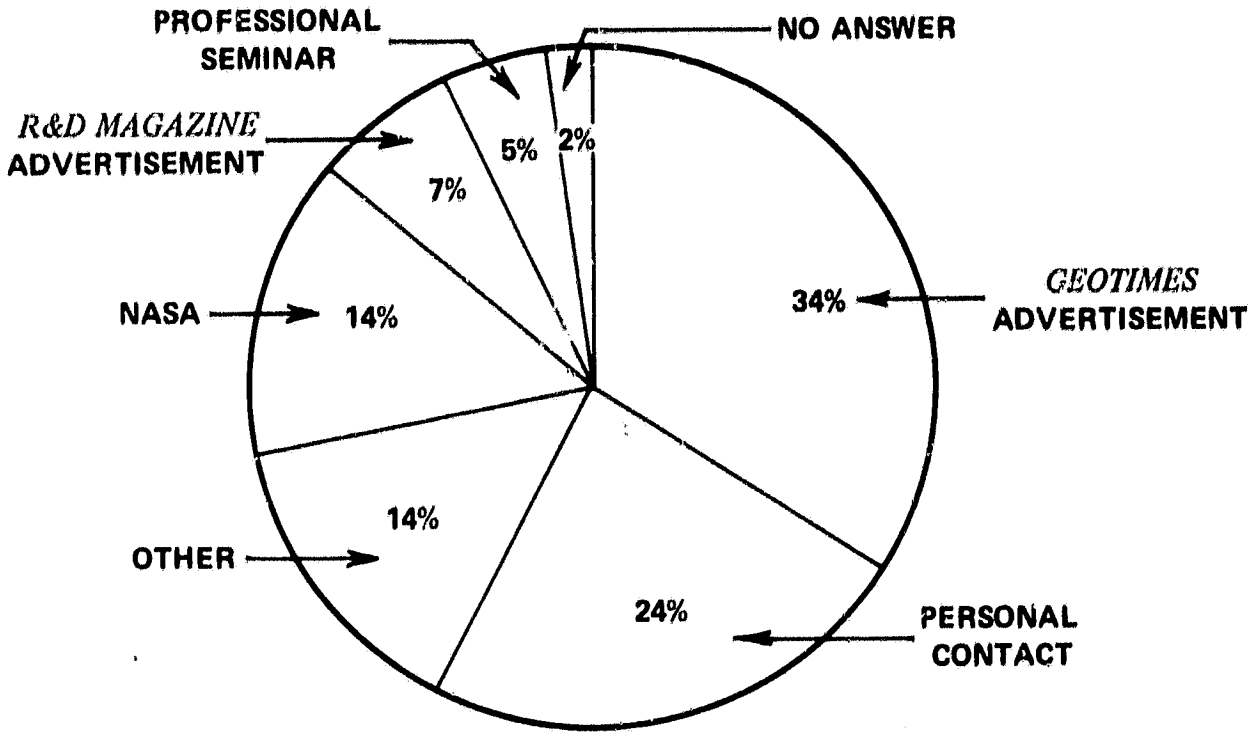
Analysis of Past Market Communication

TAC's promotional program has consisted of advertisement of available photography and photographic packages in Geotimes magazine (three insertions) and R & D magazine (one insertion). Available photography is also announced through inclusion in a TAC prepared catalog. *

Geotimes has been the single most important communication channel used by TAC in terms of generating customer awareness. Figure III-1 illustrates the relative effectiveness of all the channels of communication leading to respondents' first awareness of TAC Gemini/Apollo photographic services.

* Catalogs are nonpictorial and indicate general geographic location, percent of cloud cover, approximate angularity and lens altitude. These catalogs are available at a nominal charge.

FIGURE III-1. SOURCE OF FIRST KNOWLEDGE OF TAC PHOTOGRAPHIC SERVICE



The size of the second largest category, personal contact, implies that there is a high proportion of informal communication taking place within the potential market. In fact, personal contact was the largest single source of first awareness for all market segments except academic users (see Appendix D, Table D-3). This has several implications. First, the amount of personal contact represents the existence of informal diffusion channels which should tend to reinforce any future improvements in TAC's ability to communicate through more formalized media. This should encourage TAC to expand and improve its present promotional efforts. Second, the strong influence of informal channels makes it even more important that current users be satisfied with the photos and services they receive. Unfavorable as well as favorable experiences will tend to be diffused in a similar manner. In fact, it is probable that the size of the personal contact influence is understated for the very reason that negative informal communication did not result in an order for photographs and the resultant follow-up questionnaire. For these reasons, it is recommended that TAC follow-up in the future at least its more significant orders to insure that its performance was satisfactory.

It appeared that most respondents who cited a NASA channel (including TAC) as the source of first awareness initiated the search for the Gemini/Apollo photographs themselves, rather than responding to some form of NASA information. A breakdown showing the specific NASA contact can be found in Appendix C, Table C-12. As TAC becomes more effective in market communication through other media channels, this category should decrease in relative importance.

The academic users (the largest category) indicated that in 16.2 percent of the cases their first awareness of TAC's photographic services was through professional seminars. However, not one respondent in the second largest category (with the exception of the individual category), Crude Petroleum and Natural Gas, indicated professional seminars as a source of first awareness. Considering that nearly 96 percent of this group are geologists or geological engineers, presentations at professional seminars could be an extremely effective channel of communication. Resources permitting, it is recommended that TAC personnel actively investigate the possibilities of initiating efforts in this area.

Although R & D magazine ranked well below Geotimes in generating orders, it appeared to be more effective in reaching engineers and smaller organizations (see Appendix D, Tables D-4 and D-5). This does not indicate, however, how effective R & D magazine is relative to other media which TAC may not yet have tested. It is suggested that consideration be given to a variety of advertising alternatives.

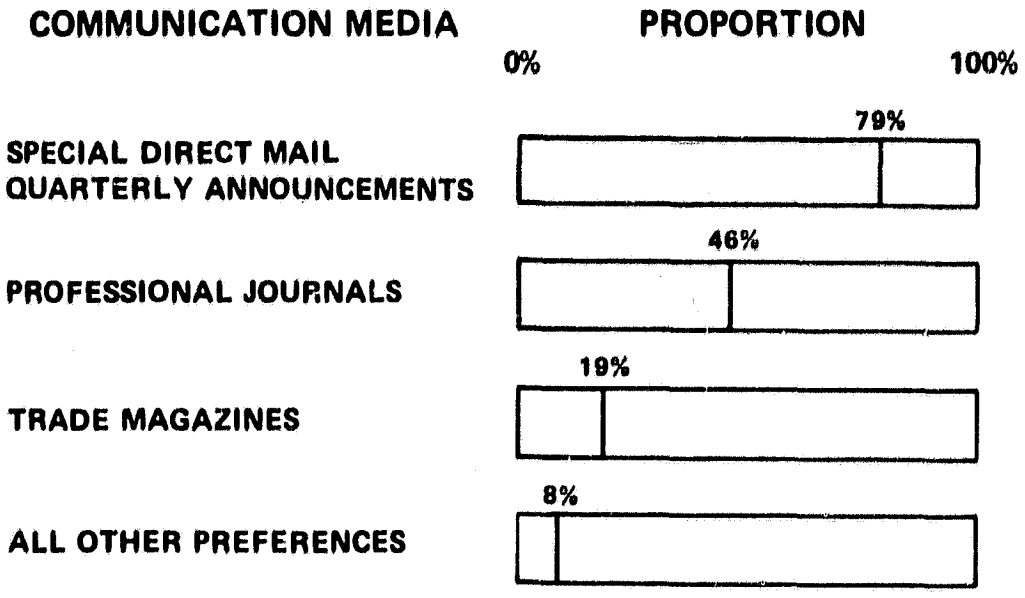
With respect to orders for specific photographs, it was found that most customers learn about the specific photographs only after their initial contact with the TAC service (see Appendix C, Table C-13).

Communication Preferences

Figure III-2 illustrates the aggregate responses for communication media preferences of past users. The overwhelming number of respondents prefer the type of catalog ordering service presently offered by TAC (see Appendix C, Table C-17) with the addition of special direct mail quarterly announcements. In addition, nearly half indicated that advertising in professional journals would be helpful. Preferences toward trade magazines and other suggestions are not significant. It should be kept in mind that these results represent the preferences of those who already know of TAC's photographic service. In this respect,

the previous discussion of current market communication is more relevant to developing new contacts. The responses show below, however, represent the best approach for maintaining communication with past customers.

FIGURE III-2. PROPORTION OF PAST USERS DESIRING THESE COMMUNICATION MEDIA



Pricing of Gemini/Apollo Photographs

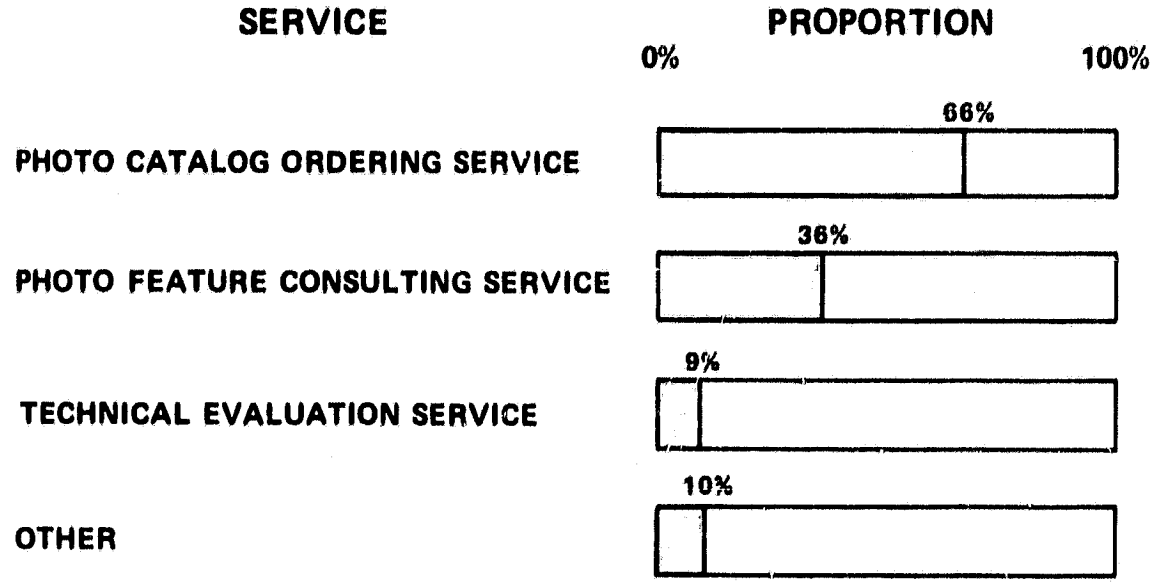
The Technology Application Center appears to have some upward flexibility in the pricing of Gemini/Apollo photographic materials. The evaluation of economic benefits received from using the photographs and the amount of multiple use (both are discussed in Section I of this report) imply that the photographic materials represent a value to past users which is larger than their cost. It is estimated that TAC prices could be increased, if required to cover costs, without seriously affecting the volume of orders.*

* Shortly after this section was prepared TAC initiated a 60 to 80 percent price increase.

Future Services Desired

Figure III-3 below shows that a photographic catalog is the most requested service desired by past users of the Gemini/Apollo photographs. Several written comments indicated that these past requesters would prefer to receive a catalog of available new photographs several times a year.

FIGURE III-3. PROPORTION OF PAST USERS INDICATING A DESIRE FOR SELECTED SERVICES



The second most requested service was a photo consulting service. Photographic users would like the ability to specify the features they wished to see when ordering the photographs and then receive help in identifying and evaluating these features. There was no indication of how much these respondents would be willing to pay for this additional effort.

Frequency of Future Needs

Analysis of questionnaire responses implied that no large volume of orders should be expected from past users unless the geographic coverage of the photographs is expanded, or new types of remote sensing photographs of the same areas are added (see Appendix C, Table C-18 and Appendix F). In this respect TAC is

seeking to broaden its data base through access to aircraft photographs taken in conjunction with NASA's Earth Resources Survey Program. The quantity of photographic materials available through this NASA program is estimated to be more than 100 times those available through the Gemini and Apollo flights.

APPENDIX A

Cover Letter and Questionnaire

University of Denver
COLORADO SEMINARY
DENVER RESEARCH INSTITUTE UNIVERSITY PARK, DENVER, COLORADO 80210

October 16, 1969

Dear

NASA's Technology Application Center (TAC) at the University of New Mexico, has asked us to conduct a study among a representative group of requestors of high altitude, earth-scanning photographs. It is quite important that your thoughts and comments be included in our evaluative effort. In this regard, your assistance should be of help to TAC in efforts to improve future service.

We have enclosed a questionnaire which raises a few questions about the photographs and data you received. We assure you that your replies will be kept confidential if you so indicate on item 14.

It is important that your answers to the questions be included in our study, since we are contacting only a limited number of people requesting information from TAC. No postage is required when your questionnaire is returned to us in the enclosed envelope.

Thank you for your help.

Sincerely,

Robert W. Joselyn
Industrial Economics Division

RWJ:bb
Enclosure

Bureau Budget Approval No. 104-R0049

University of Denver
COLORADO SEMINARY

DENVER RESEARCH INSTITUTE UNIVERSITY PARK, DENVER, COLORADO 80210

TAC-Photo and Data Service Improvement Questionnaire

INSTRUCTIONS: After reading each question, please check the box next to the answer which applies to your past request for high altitude, earth-scanning photos and/or related information. If more than one answer applies, check each of the applicable answers. Where a question requires a written answer, be as specific as possible. Feel free to make any additional comments and suggestions concerning specific questions on the back of any page of the questionnaire.

1. Indicate the general "category of user" that best fits your occupational use of high altitude, earth-scanning photos and/or related information. (Check only one box)

ACADEMIC

- ☐ College teacher
- ☐ High school teacher
- ☐ University researcher
- ☐ Other (specify) _____

GOVERNMENT (Indicate your job classification and department designation)

- ☐ Federal _____
- ☐ State _____
- ☐ Local _____

INDUSTRIAL

- ☐ New product or service research and development staff
- ☐ Existing product or service related (specify your job classification)

_____

PERSONAL (Explain)

- ☐ Professional (specify your profession) _____
- ☐ Non-professional _____

2. How did you first learn about the Technology Application Center's (TAC's) high altitude, earth-scanning photo and data service?

- ☐ Advertisement in Geotimes magazine
- ☐ Advertisement in Research & Development magazine
- ☐ NASA (indicate office or center) _____
- ☐ Professional seminar
- ☐ Personal contact
- ☐ Other _____

3. What are the technical backgrounds of all the individuals (including yourself) using the photographs? (Check categories and indicate approximate number involved)

- ☐ Engineer (type) _____
- ☐ Earth Scientist (type) _____
- ☐ Physical Scientist (type) _____
- ☐ Biological Scientist (type) _____
- ☐ Management (general) _____
- ☐ Marketing _____
- ☐ Other (specify) _____

4. What type of photo coverage did you request from TAC?

- ☐ Coverage of a specific geographic area
- ☐ Photos dealing with a specific geography or topography problem

A particular disciplinary package

- ☐ Geology
- ☐ Hydrology
- ☐ Oceanography
- ☐ Geography
- ☐ Meteorology
- ☐ Land Use, Urban Studies
- ☐ Peru Saturation Coverage
- ☐ Southwestern U.S. & Northern Mexico
- ☐ Other _____

5. If specific photos (ex. -El Paso, Texas) or support data were requested, how did you learn of their identity? _____

- ☐ None Requested

6. What was the general use for the photographs? Please indicate a priority of applications where more than one is involved (i.e., 1, 2, 3, etc.)

- ☐ Classroom instruction
- ☐ Advertising
- ☐ Display

Discipline oriented research or application

- ☐ Oceanography
- ☐ Geology
- ☐ Hydrology
- ☐ Meteorology
- ☐ Geographic Reconnaissance
- ☐ Land Utilization (specify) _____
- ☐ Other Remote Sensing _____
- ☐ Other Application _____

7. Briefly explain your uses in greater detail if you checked "Discipline oriented research or application" in question six above. _____

8. Please rate each one of the service characteristics below. Feel free to elaborate on the back of the previous page.

Rate	Needs Improvement	Adequate for Use	Excellent
Photo reproduction quality	_____	_____	_____
Photo color adequacy	_____	_____	_____
Accuracy of accompanying information	_____	_____	_____
Promptness of TAC service	_____	_____	_____
Applicability to your needs	_____	_____	_____
TAC's advertising of available information	_____	_____	_____

9. What was the approximate dollar size of your order?

$ _____

10. What was the approximate economic benefit of the service to you in your work?

- ☐ No value (explain) _____
- ☐ Worth only its cost
- ☐ Worth twice its cost
- ☐ Worth ten times its cost
- ☐ Worth at least twenty times its cost

11. What type(s) of high altitude, earth-scanning photo and data service(s) do you need? (If more than one answer applies, please rank in order of frequency of need--i.e., A-most often needed, B-next most often needed, etc.)

- ☐ Photo catalog ordering service
- ☐ Photo feature consulting service (i.e., ability to specify what features you wish to see)
- ☐ Technical evaluation service (evaluation of data for your use--supplying you answers to your problem)
- ☐ Other _____

_____

12. How would you describe your projected needs for high altitude, earth-scanning photographs and related data over the next five to ten years? Please indicate the nature as well as the frequency of these needs. _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

13. What would you consider to be the best way of informing you of new photo coverage? (Rank answers in order of effectiveness if more than one applies)

- ☐ Trade magazines
- ☐ Professional journals
- ☐ Special quarterly announcements (including you on a mailing list)
- ☐ Other (please specify) _____

14. Do some of your responses contain proprietary information? If yes, please indicate which ones. No information which you identify as proprietary will be associated with you or your organization.

- ☐ Yes (specify) _____
- ☐ No

_____ _____

Your Name (please print) Your Title (please print)

Please return completed questionnaire to:

University of Denver
PATT
P.O. Box 10127
Industrial Economics Division
Denver Research Institute
Denver, Colorado 80210

THANK YOU FOR YOUR COOPERATION

APPENDIX B

Response Rate By Category of User

TABLE B-1. RESPONSE RATE BY CATEGORY OF USER

Category	MAILING		RETURNS		
	Number in Category	Percent in Category	Number of Returns	Percent Return in Category	Percent of Usable Returns
Company	107	29.3%	79	75%	71%
Government	24	6.6	19	79	75
Schools	95	26.0	65	69	61
Individual	53	14.5	46	87	79
Miscellaneous	6	1.6	3	50	34
University	80	21.9	56	70	68
TOTALS	365	100.0%	268	74%	69%

Notes:

(1) The "Total Percent of Usable Returns" column was calculated by subtracting unanswered questionnaires which were returned from the total number of returns.

(2) The "Categories of Users" used for the mailing list do not correspond with the General Category of User segments developed for responses to question one.

APPENDIX C

Summary of Responses to the Questionnaire

TABLE C-1. BREAKDOWN OF RESPONSES BY GENERAL CATEGORY OF USER

Percent of Total	General Category	Specific Category	Number of Responses	Percent of Total Responses
47%	Academic	College Teacher	69	29%
		High School Teacher	8	3
		University Researcher	26	11
		Other Academic	11	5
8	Government	Federal Government	11	5
		State Government	3	1
		Local Government	4	2
23	Industrial	Industrial (New Product)	23	10
		Industrial (Existing Product)	33	14
11	Individual	Individual (Professional Use)	27	11
11	Individual Non-professional Use	Individual (Nonprofessional Use)	26	11
100%		TOTALS*	241	100%

TABLE C-2. DISCIPLINARY BACKGROUND OF MAIN USER

Background Category	Number of Responses	Percent of Total Responses
Engineer	22	9%
Earth Scientist	164	69
Physical Scientist	13	6
Biological Scientist	5	2
Management	4	2
Marketing	0	0
Other	29	12
TOTALS	237	100%

*Note: Percentages may not add to 100 because of rounding.

TABLE C-3. DOLLAR SIZE OF ORDER
(RESPONSES TO QUESTION NINE)

Cost Range	Number	Percent of Total
$0	11	5%
$1-10	44	18
$11-49	80	33
$50-99	32	13
$100-499	37	15
$500 plus	6	2
Unknown	31	13
TOTALS	241	100%

TABLE C-4. RESPONDENT BY COMPANY SIZE

Company Size (Employees)	Frequency	Percent of Total
1-10	43	18%
11-50	0	0
51-100	2	1
101-500	2	1
501-1,000	5	2
1,001-5,000	30	12
5,001-10,000	27	11
10,001 & up	77	32
Unknown	55	23
TOTALS	241	100%

TABLE C-5. RESPONDENTS BY STANDARD INDUSTRIAL CLASSIFICATION

SIC	Industry	Frequency	Percent of Total
00	Individual	42	17%
10	Metal Mining	3	1
13	Crude Petroleum & Natural Gas	28	12
14	Mining, Non-Metallic Minerals	1	1/2
20	Food Products	1	1/2
27	Printing	1	1/2
28	Chemicals	1	1/2
29	Petroleum Refining	5	2
33	Primary Metals	2	1
35	Nonelectrical Machinery	1	1/2
36	Electrical Machinery	2	1
37	Transportation Equipment	5	2
38	Scientific Instruments	1	1/2
45	Air Transportation	1	1/2
48	Communications	1	1/2
49	Electricity, Gas, Sanitary Service	3	1
61	Other Credit Agencies	1	1/2
73	Miscellaneous Business Services	2	1
82	Educational Services	105	44
89	Miscellaneous Services	2	1
91	Federal Government	15	6
92	State Government	1	1/2
	Unknown	17	7
	TOTALS	241	100%

C-6. PHOTOGRAPHY USERS BY GEOGRAPHICAL LOCATION

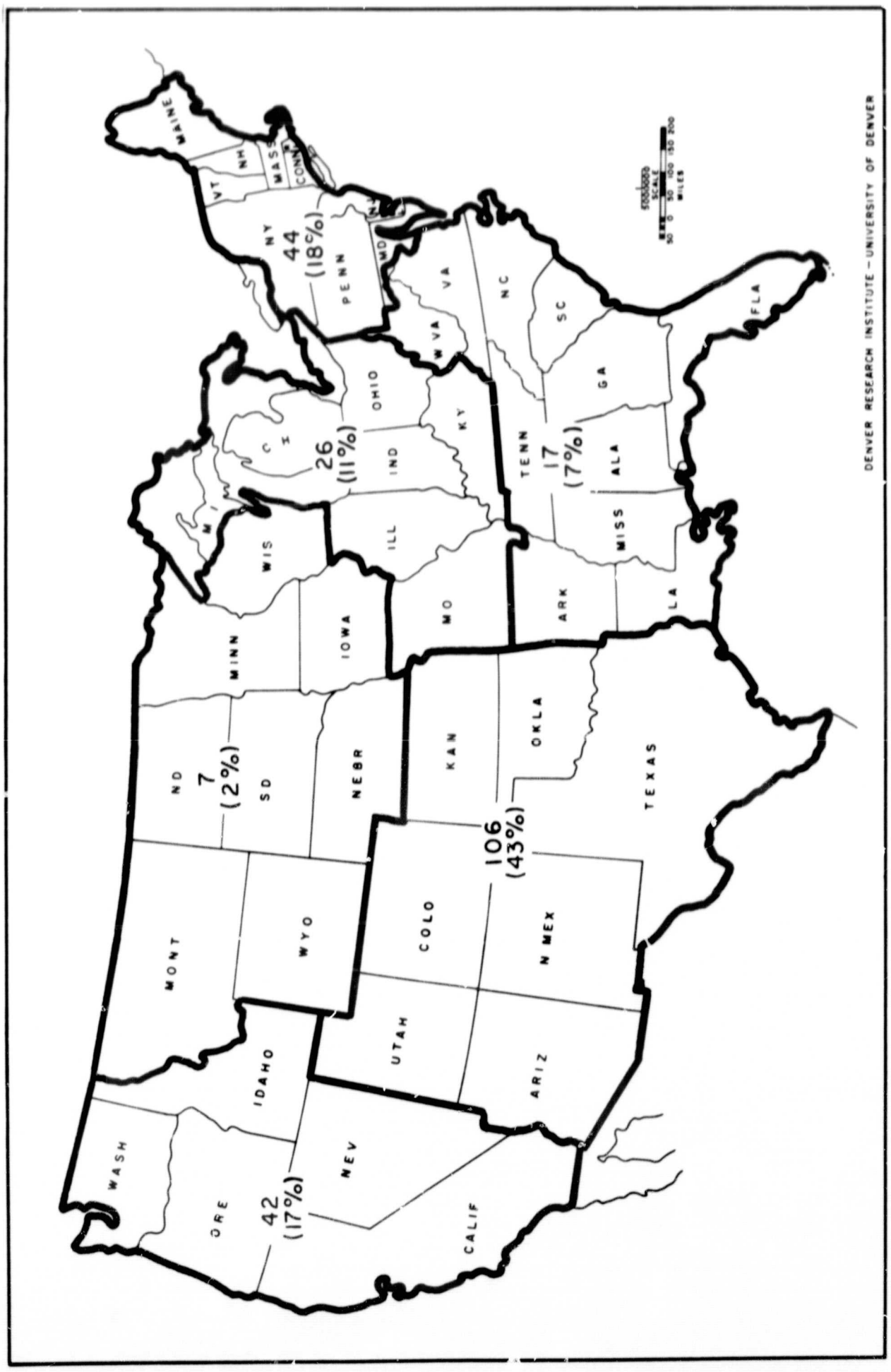


TABLE C-7. MAIN USE OF PHOTOGRAPHS

			Number	Percent of Total
Classroom Instruction			92	39%
Advertising			2	1
Display			20	8
Discipline-Oriented Research or Application			123	52
1. Oceanography	1	0%		
2. Geology	73	31		
3. Hydrology	2	1		
4. Meteorology	2	1		
5. Geographic Reconnaissance	19	8		
6. Land Utilization	2	1		
7. Other Remote Sensing	5	2		
8. Other Application	19	8		
Totals	123	52%		
TOTALS			237	100%

TABLE C-8. FREQUENCY OF MULTIPLE USES PER ORDER
(RESPONSES TO QUESTION SIX)

	Number	Percent of Total
One use only	123	52%
Two uses	64	27
Three uses	29	12
Four uses	12	5
Five uses	3	1
Six uses	2	1
Seven uses	3	1
TOTALS	236	100%

TABLE C-9. ALL USES OF PHOTOGRAPHS AND DATA
(SUMMARY OF MULTIPLE RESPONSES TO QUESTION SIX)

	Number	Percent of Respondents Indicating Use
Classroom Instruction	106	45%
Advertising	2	1
Display	37	16
Discipline-Oriented Research and Application		
Oceanography	22	9
Geology	125	53
Hydrology	18	8
Meteorology	11	5
Geographic Reconnaissance	48	20
Land Utilization	19	8
Other Remote Sensing	13	6
Other Application	37	16

TABLE C-10. SOURCE GENERATING FIRST KNOWLEDGE OF TAC SERVICE (RESPONSES TO QUESTION TWO)

Category	Number of Responses	Percent of Total Responses
No Answer	5	2%
Geotimes Advertising	83	34
R & D Magazine	16	7
NASA	34	14
Professional Seminar	12	5
Personal Contact	58	24
Other	33	14
TOTALS	241	100%

TABLE C-11. BREAKDOWN OF "OTHER" CATEGORY IN QUESTION TWO

Category	Number	Percent of Total
Friend or Associate	6	21%
Technology Application Center	8	29
Professional Society Service	5	18
Baja California Society	1	3
Other	8	29
TOTALS	28	100%

TABLE C-12. BREAKDOWN OF NASA RESPONSES TO QUESTION TWO

Category	Number	Percent of Total
Manned Spacecraft Center	12	40%
NASA Headquarters-Washington	9	30
Technology Application Center	5	17
Marshall Space Flight Center	1	3
Other	3	10
TOTALS	30	100%

TABLE C-13. SOURCE OF KNOWLEDGE PERTAINING TO THE EXISTENCE OF SPECIFIC PHOTOGRAPHS (RESPONSES TO QUESTION FIVE)

Source	Number	Percent of Total
TAC-Originated Catalog or Index	61	50%
Personal Visit to TAC Center	5	4
Personal Contact with NASA Office	12	10
General NASA Publication	9	7
Magazine Advertisement	3	2
Magazine Story	8	6
Professional Society Meeting or Literature	5	4
Friend or Associate	10	8
Other	10	8
TOTALS	123	100%

TABLE C-14. COMMUNICATION MEDIA PREFERENCE
(RESPONSES TO QUESTION THIRTEEN)

Medium	Number of Responses	Percent of Total Respondents Checking Category
Trade Magazines	46	19%
Professional Journals	110	46
Special Quarterly Announcements	190	79
Other	18	8

TABLE C-15. CUSTOMER EVALUATION OF SERVICE CHARACTERISTICS

Characteristics	Needs Improvement	Adequate for Use	Excellent	Total
Photo Reproduction Quality	16%	47%	37%	100%
Photo Color Adequacy	14	53	34	100
Accuracy of Accompanying Information	41	46	13	100
Promptness of TAC Service	23	44	33	100
Applicability to Your Needs	12	58	30	100
TAC's Advertising of Available Information	58	33	9	100

TABLE C-16. EVALUATION OF ECONOMIC BENEFIT FROM PHOTOS
(RESPONSES TO QUESTION TEN)

Evaluation	Number	Percent of Total
Education Use--Value not Determinable	44	22%
Difficult or Impossible to Measure	32	16
Did Not Expect Economic Benefit	33	16
No Value	11	5
Worth Only its Cost	28	14
Worth Twice its Cost	22	11
Worth Ten Times its Cost	24	12
Worth at Least Twenty Times Cost	10	5
TOTALS	204	100%

TABLE C-17. SERVICES DESIRED IN THE FUTURE
(RESPONSES TO QUESTION ELEVEN)

Service	Number of Responses	Percent of Total Respondents Checking Category
Photo Catalog Ordering Service	159	66%
Photo Feature Consulting Service	88	36
Technical Evaluation Service	21	9
Other	25	10

TABLE C-18. GENERAL CATEGORIZATION OF FREQUENCY OF FUTURE NEEDS
(RESPONSES TO QUESTION TWELVE)

Frequency of Need	Number	Percent of Total
Little or no Need (zero to once/year)	60	52%
Occasional Need (two to five times/year)	34	30
Frequent Need	25	22
TOTALS	115	100%

APPENDIX D

Selected Cross Tabulations of Questionnaire Responses

TABLE D-1. GENERAL ORGANIZATION SEGMENT VS. DISCIPLINARY BACKGROUND OF MAIN USER

Background of Main User	Academic	Government	Industry	Personal Professional	Personal Non-professional	All Segments
Engineer	6%	22%	4%	8%	29%	9%
Earth Scientist	72	44	93	73	17	69
Physical Scientist	6	6	2	4	12	6
Biological Scientist	2	6	0	4	4	2
Management	0	6	2	0	8	2
Marketing	0	0	0	0	0	0
Other	14	17	0	12	29	12
TOTALS*	100%	100%	100%	100%	100%	100%

TABLE D-2. GENERAL ORGANIZATION SEGMENT VS. MAIN USE OF PHOTOS

Main Use	Academic	Government	Industry	Personal Professional	Personal Non-professional	All Segments
Classroom Instruction	75%	11%	6%	0%	9%	39%
Advertising	1	0	0	4	0	1
Display	3	22	4	15	30	8
Oceanography	0	0	2	0	0	0
Geology	10	28	76	41	0	31
Hydrology	0	6	0	0	0	1
Meteorology	1	6	0	0	0	1
Geographic Reconnaissance	8	6	0	11	26	8
Land Utilization	0	0	4	0	0	1
Other Remote Sensing	1	6	4	4	0	2
Other Application	2	17	2	22	36	8
TOTALS	100%	100%	100%	100%	100%	100%

*Note: Percentages may not add to 100 because of rounding.

TABLE D-3. GENERAL ORGANIZATION SEGMENT VS. FIRST KNOWLEDGE OF TAC SERVICE

First Knowledge Source	Academic	Government	Industry	Personal Professional	Personal Non-professional	All Segments
No Answer	1%	0%	4%	4%	4%	2%
Geotimes	48	6	30	30	12	34
R & D Magazine	8	0	4	4	15	7
NASA	13	28	18	11	0	14
Professional Seminar	4	17	4	7	4	5
Personal Contact	18	33	32	33	19	24
Other	9	17	9	11	46	14
TOTALS	100%	100%	100%	100%	100%	100%

TABLE D-4. DISCIPLINARY CLASSIFICATION OF MAIN USER VS. SOURCE OF FIRST AWARENESS OF MAIN USER

First Knowledge Source	Engineer	Earth Scientist	Physical Scientist	Biological Scientist	Management	Other	Total
No Answer	0%	2%	0%	0%	0%	0%	2%
Geotimes	26	48	9	25	33	3	34
R & D Magazine	17	3	9	0	0	10	7
NASA	13	13	27	25	0	10	14
Professional Seminar	13	5	0	0	0	3	5
Personal Contact	22	20	45	0	66	35	24
Other	9	9	9	50	0	38	14
TOTALS	100%	100%	100%	100%	100%	100%	100%

TABLE D-5. SIZE OF ORGANIZATION VS. SOURCE OF FIRST KNOWLEDGE OF TAC GEMINI/APOLLO PHOTOGRAPHS

Size Number of Employees	Geotimes	R & D	NASA	Professional Seminar	Personal Contact	Other	Total
Unknown	11%	18%	32%	18%	23%	21%	20%
1-10	13	46	0	18	18	18	29
11-50	0	0	0	0	0	0	0
51-100	2	0	0	0	0	0	1
101-500	0	0	0	0	0	0	0
501-1,000	4	0	0	9	5	0	3
1,001-5,000	26	18	14	9	0	4	13
5,001-10,000	13	0	4	18	10	4	9
10,001 and over	30	18	50	27	44	42	37
TOTALS	100%	100%	100%	100%	100%	100%	100%

TABLE D-6. GENERAL ORGANIZATION SEGMENT VS. ECONOMIC BENEFITS

Evaluation	Academic	Government	Industry	Personal Professional	Personal Non-professional	All Segments
Educational Use-Value Unknown	40%	11%	5%	4%	4%	22%
Impossible to Measure	6	33	45	28	0	16
Did Not Expect Economic Benefit	1	11	10	20	88	16
No Value	9	11	12	8	0	5
Worth its Cost	14	11	10	6	4	14
Worth Twice its Cost	13	6	7	8	0	1
Worth Ten Times Cost	14	17	7	4	4	12
Worth at Least Twenty Times Cost	3	0	5	16	0	5
TOTALS	100%	100%	100%	100%	100%	100%

TABLE D-7. TYPE OF SERVICE VS. GENERAL ORGANIZATION SEGMENT

	(Percent of Category Requesting Particular Service)				
Service Needed	Academic	Government	Industry	Personal Professional	Personal Non-professional
Catalog Service	71%	61%	71%	59%	58%
Photo Feature Consulting Service	46	28	33	22	19
Technical Evaluation Service	11	6	18	11	8
Other	12	0	5	18	8

TABLE D-8. EVALUATION OF PHOTO REPRODUCTION QUALITY BY USER SEGMENTS

User Segment	Needs Improvement	Adequate For Use	Excellent	Total
Academic	9%	51%	40%	100%
Government	24	47	29	100
Industry	26	49	25	100
Personal Professional Use	16	32	52	100
Personal Nonprofessional Use	17	35	48	100

TABLE D-9. EVALUATION OF PHOTO COLOR ADEQUACY BY USER SEGMENTS

User Segment	Needs Improvement	Adequate For Use	Excellent	Total
Academic	12%	54%	34%	100%
Government	12	53	35	100
Industry	22	53	25	100
Personal Professional Use	9	39	52	100
Personal Nonprofessional Use	13	43	44	100

TABLE D-10. EVALUATION OF THE PROMPTNESS OF TAC SERVICE BY USER SEGMENT

User Segment	Needs Improvement	Adequate For Use	Excellent	Total
Academic	18%	43%	39%	100%
Government	56	19	25	100
Industry	30	51	19	100
Personal Professional Use	21	38	42	100
Personal Nonprofessional Use	48	35	17	100

TABLE D-11. EVALUATION OF THE ACCURACY OF ACCOMPANYING INFORMATION BY USER SEGMENT

User Segment	Needs Improvement	Adequate For Use	Excellent	Total
Academic	49%	38%	13%	100%
Government	36	54	9	100
Industry	37	59	4	100
Personal Professional Use	21	38	42	100
Personal Nonprofessional Use	48	35	16	100

TABLE D-12. EVALUATION OF THE APPLICABILITY TO NEEDS BY USER SEGMENT

User Segment	Needs Improvement	Adequate For Use	Excellent	Total
Academic	11%	55%	34%	100%
Government	0	53	47	100
Industry	19	56	25	100
Personal Professional Use	13	48	39	100
Personal Nonprofessional Use	0	70	30	100

TABLE D-13. EVALUATION OF TAC's ADVERTISING OF AVAILABLE INFORMATION BY USER SEGMENT

User Segment	Needs Improvement	Adequate For Use	Excellent	Total
Academic	63%	28%	9%	100%
Government	50	44	6	100
Industry	53	41	6	100
Personal Professional Use	45	30	25	100
Personal Nonprofessional Use	67	29	5	100

APPENDIX E

Selected Responses Pertaining to Specific Photographic Uses

"Research--the optical and radiometric properties of terrestrial surfaces."

"We are attempting to measure changes in area extent and volume of open-pit copper mines and dumps."

"Investigation of metallogenic trends and color trends in mineralized areas."

"Can see the effects of currents and wind on the sedimentary environments, which result in a specific geometric pattern."

"Huge geologic and geomorphological features have been recognized from Gemini photos, and later verified on the ground, that previously were only remotely suspected if at all. These that I have been concerned with have had a direct bearing on the explanation of why a Paleo-Indian population intensively inhabited one area of southern Arizona 10,000 to 11,000 years ago and not some other. In other respects these high-altitude photographs have proven to be more valuable than conventional maps."

"Fluvial geomorphology and hydrology applied to rivers."

"To determine areas along the Nile River where Pleistocene sediments were preserved."

"State geologic map, geothermal reconnaissance, irrigation disposal of municipal and industrial effluent."

"Mainly teaching."

"Exploration for oil and gas using air photos to locate geologic structure."

"Regional structures possibly related to copper deposits."

"Extracurricular investigations as to the fundamental cause of the deformation of the earth's crust began as a purely fortuitous combination of air photo and surface based data. From this evolved a rational tectonic theory concerning the processes of erosion, sedimentation, and eventually commercial oil accumulation. NASA photography can furnish a part of the empirical evidence that is needed to confirm or refute the present conjectures which for the present must be withheld."

"16 by 16 color print used to check campsite locations in relation to topo features, shrub and forest areas (for food supplies), trail development in relation to topography, recent topo changes, in connection with study of occupation of area by man over 10,000 - 12,000 or more years to present time. Used to demonstrate features in lectures. With permission, plan to use photos and details in articles in professional journals and in final report on archeology of the Sa Pinaccate, Sonora, Mexico, for University of Arizona, now in partial preparation."

"I am interested in the possible application of space photos to the problems of oil exploration--that is, to the following: (1) the nature of the rocks, whether igneous in origin or sedimentary and, therefore, likely to contain hydrocarbons. (2) If sedimentary, do they in fact contain hydrocarbons--even widely disseminated? (3) Structural features of the area. Are there traps in which petroleum might accumulate?"

"Drainage pattern analysis, large structural feature identification, soil tone analysis, areal geology identifications, fracture pattern and lineament analysis."

"Used with 9-12th grade students in geography and social science courses at _____ High School, _____ California, in Geography for Teachers course at College, and at NDEA-EPDA _____ University. Main aim to give different viewpoint, compare with maps, learn patterns not easily viewed from other media of instruction."

"Used in Oceanography I & II course. Showing new remote sensing instrumentation. Part of lab work--students to research possible new research and instrument techniques in oceanography and meteorology. Slides used as examples of remote sensing!"

"Used to teach beginning geology students landforms and geologic structures."

APPENDIX F

Selected Responses Relating to Future Photographic Needs

"Mostly for classroom use in oceanography and geology classes. Depends on areas covered and written material or explanations available."

"Difficult to say--should use the technique to the extent that it improves ones teaching and or aids the students learning."

"Will continue high as more coverage and repeated coverage is obtained. Needed both for research and instruction."

"To date, Gemini and Apollo photographs have been incidental to more basic mission objectives. When satellites can obtain near vertical coverage with large format cameras specifically designed for the purpose, in areas needed and not restricted to the equatorial-temperature belt, potential uses in natural resource exploration will be many indeed. Our use would be geologic, geomorphic and color evaluation. Many areas of interest are not viewed now. We would use all coverage we could obtain. I would like to see also ultra-high resolution black and white film (and lenses) used in satellite photography. The potential uses would be vast if state-of-the-art military photographic resolutions could be used in satellite photography for scientific users."

"Continuing with the thought I was developing under #10 (above) I feel that these photos will be utilized by the geologic profession in general and by me in particular in regional exploration planning especially in areas we are unlikely to or will never visit but yet be responsible for; e. g., the Canadian Arctic. The needs would likely be sporadic at first, then as more frequent use of stereo pairs came into being, possibly a more steady demand would be realized. What most of us do not know is what you have and what we might be able to do with it--mineral and oil exploration planning and exploitation."

"We have just added a 'remote sensor' to our staff. Professor _____ plans to offer several courses dealing with the technique, application, and relevance of remote sensing images. His need for photographs and related data will be critical or the department's holdings are limited."

"There is a need for coverage of selected regions where there are differences in climate, vegetation, soils, land use, etc. Several times a year to document seasonal changes and relate these to differences in previously indicated parameters."

"No frequent requests anticipated. When required, need will be for generalized selections rather than specific earth areas."

"I heard discussed at one time--a plan for a north-south orbiting satellite that would ultimately photograph the entire surface with resulting scale photos of any area on say--1:250,000--or 1 inch equal approx. 4 miles. This would be ideal for the resolution we need and the scale accuracy and detail."

"Needs are difficult to project, since they will depend on availability of specific geographic coverage, but I anticipate they will be in a relatively low level--possibly one to five orders per year comparable to the ones described above, i.e., $50 to $250 worth per year."

"Unknown. Present project probably will continue five years or more, may need detailed sections of existing photos (see 11 above). May extend southward along coast of Gulf or Lower California in future."

"I believe these photos will have fairly high value to me over the next few years but I have no way of predicting the nature or frequency."

"Anticipate teaching at college level and expect to order for classroom use (multiple copies) at app. 20-50 new prints per year. Also hope to do geographic pattern research using earth scanning photos. Probably order representative sampling of areas from each new flight. In other words expect sizable increase in needs over next 5-10 years."

"Need coverage above 32 degrees lat. (N. America) in land areas, as much as possible."

"Response of students to the photos has been very good. I wish we had more, but also, a wider variety in terms of features shown and geographic extent of coverage."

"We will need, in the next 5 to 10 years, as much high-altitude photography as is available. I feel we have just begun to scratch the surface in terms of geologic problems solvable through the use of high-altitude photography."

"Personally, I believe we will acquire just about everything that becomes available, if we can determine what is available. I would like to see more sets developed--complete instructional units, if you will also, I personally feel that overhead slides would be of immense value."

"All sections useful to general geographic studies - for repeated classroom use - could use regular catalog 'addendem' - useful to general, topical as well as regional courses - especially applicable to media-centered, training courses. This material should become a regularly used geographic research tool. Suggest TAC catalogs and materials be displayed at AAG and NCHE conference."

"Classic examples of geological, meteorological and oceanographic features and formations for classroom use. Frequency would depend on availability of new examples of such features."